CUSTOMER CASE STUDY

Olefins Pyrolysis Furnace Optimization and Alarm Reduction

BKOAI used mode-based alarming and predictive control to reduce nuisance alarms and improve reliability in olefins pyrolysis furnaces

Solution: Modal Alarming & Quench MPC **Industry:** Petrochemicals

Use Case Focus: Alarm Reduction & Quench Control

GOALS

- Reduce nuisance alarms during critical furnace operation transitions.
- Improve furnace transition handling to maintain process stability.
- Minimize manual operator interventions during complex quench cycles.
- Increase control reliability in olefins pyrolysis furnace operations.

CHALLENGES

- High alarm volumes during furnace transitions overwhelm control room operators.
- Distinguishing critical process events from nuisance alarms is highly difficult.
- Quench control processes involve complex, interactive multivariable dynamics.
- Operators must frequently intervene manually to maintain stable system conditions.

SOLUTIONS

- Develop specialized modal alarming software for olefins pyrolysis operations.
- Implement user-friendly operator-facing interfaces for real-time monitoring and control.
- Install multivariable model predictive control systems for furnace quench processes.
- Optimize transitional operational logic to automate baseline stabilization processes.

RESULTS

- Nuisance alarms during furnace transitions were significantly decreased.
- Overall alarm rates dropped to safer, more manageable operating levels.
- Manual operator interventions were successfully minimized across both operational phases.
- Control reliability of the pyrolysis furnace operations was greatly improved.

EXECUTIVE SUMMARY

Managing olefins pyrolysis furnaces presents significant operational challenges, particularly due to high alarm volumes during transition states and the complex multivariable dynamics of quench control. To address these issues, an advanced optimization project implemented specialized modal alarming software alongside modern operator interfaces. Additionally, multivariable model predictive control was deployed to automate and stabilize quench operations. This integrated solution successfully reduced nuisance alarms, decreased operator workload, and significantly enhanced furnace control reliability, leading to safer and more efficient olefins production.

Addressing the Complexity of Pyrolysis Furnace Transitions

Olefins pyrolysis furnaces are highly complex assets that operate under extreme conditions, where transitions can trigger a flood of alarms. During these phases, control operators frequently struggle to differentiate critical, actionable process events from routine nuisance alarms. This high cognitive load increases the risk of delayed responses to genuine process upsets. Additionally, managing quench control involves navigating multivariable process dynamics. Without advanced automation, operators must continuously intervene manually, leading to operational variability, decreased reliability, and suboptimal furnace performance.

Implementing Modal Alarming and Model Predictive Control

To resolve these challenges, a two-pronged automation strategy was deployed. First, specialized modal alarming software and intuitive operator-facing interfaces were implemented to dynamically suppress nuisance alarms based on the furnace's active operating state. Second, a multivariable model predictive control system was installed specifically for the pyrolysis furnace quench control. This advanced system automatically manages the complex, interacting variables of the quench process, drastically reducing the need for manual operator adjustments. Together, these technologies established a more stable, reliable, and operator-friendly production environment.